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Report of the Chief of the Bureau of Human Nutrition and Home Economics, Agricultural Research Administration, 1949

UNITED STATES DEPARTMENT OF AGRICULTURE,
Washington, D. C., September 23, 1949.

DR. P. V. CARDON,
Agricultural Research Administrator.

DEAR DR. CARDON: I submit herewith the report of the Bureau of Human Nutrition and Home Economics for the fiscal year ended June 30, 1949.

Sincerely,

HAZEL K. STIEBELING,
Chief.

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High incomes and general prosperity do not eliminate problems of choice that face the American family. Even with food plentiful throughout the country, with consumer goods produced in great variety, and with services more readily obtained than during the war and early postwar years, the well-being of the family today, as always, depends greatly upon the wisdom of its choices.

As a whole the Nation's families are better off from an economic standpoint than in the 1930's, although the range in income still is wide, and the incomes of many are modest. Families that can afford some margin over necessities, as well as those in lower income groups, must carefully weigh one menu against another in terms of cost, nutritive value, and other satisfactions.

New developments in marketing and processing present new foods or old foods in new forms or new containers. New fabrics and new or greatly improved household appliances are appearing on the market in bewildering array. To select wisely the consumer must have a background of pertinent knowledge, and manage with thoughtfulness and skill.

Through research in food and nutrition, textiles and clothing, and housing and household equipment the Bureau of Human Nutrition and Home Economics seeks to provide basic scientific information for the Extension Service and other teachers and leaders to use in consumer education, and for producers to use in planning the production and marketing of products well suited to family needs. Popular publications based on such research also help families choose and effectively use the products of American agriculture and industry.

As part of its economic studies relating to family living, the Bureau collects and analyzes data which show the extent and adequacy of present consumption of food, textiles, and other goods and services. Such facts are used by educators in developing programs to help families make better use of their resources, and by public leaders and administrators concerned with national policies and programs.

This report gives examples of research accomplishments, and publications prepared during the fiscal year 1949.

DIETARY LEVELS AND POTENTIAL FOOD CONSUMPTION

In broad outline, over-all statistics portray a national food supply generous in quantity and variety of foods as well as in the nutrients they provide. Some details of the picture are filled in by data emerging from recent studies of the food consumption of urban families and a small study of diets of rural families.

The urban studies, supported by funds authorized by the Research and Marketing Act of 1946, provide facts as to the food consumed by town and city families in 1948, and show the influence of geographical location, season of year, income, and family size on household use of food. Information on these points at fairly frequent intervals is useful to farmers, food processors, and tradesmen who want to know more about their present and potential markets. This information is equally valuable to home economists and social workers who want to know how well Americans are eating so as to direct their educational emphases accordingly.

The study of rural diets covered families living in the open country, in a single county in Ohio and one in Georgia. This work was done with funds appropriated directly to the Bureau by the Congress.

City Family Diets

Reported to date (June 30, 1949) are figures concerning the food consumed in the spring of 1948 by almost 1,600 families in 68 urban communities representing a cross section of cities throughout the United States, and by more than 1,000 families in four cities (San Francisco, Birmingham, Minneapolis-St. Paul, and Buffalo) in the preceding winter months.

National sample, spring 1948

City families the country over were found to be spending about a third of their income for food in the spring of 1948. The averages ranged from 17 percent for families with incomes of \$7,500 or more to 48 percent for those under \$2,000. Of the city family's money for food, 32 percent was used for meat, fish, poultry, and eggs; 16 percent for milk and milk products other than butter; 21 percent for vegetables and fruit; and 31 percent for all other items—grain products, fats and oils, sugars, sweets, and accessories.

In a comparable study made in the spring of 1942, urban families were spending only about a quarter of their income for food. The quantities of each of the major types of food bought by families in the two periods are summarized below:

		<i>Quantity purchased to eat at home in a week—Spring</i>	
		1942	1948
Item:			1948 as per- cent of 1942
Milk (fluid equivalent) ¹	Quarts.....	12. 93	15. 92
All vegetables and fruits.....	Pounds.....	39. 48	41. 06
Potatoes, sweetpotatoes.....	do.....	8. 83	7. 26
Dry beans and peas, nuts.....	do.....	. 89	. 94
Green and yellow vegetables.....	do.....	7. 69	7. 63
Tomatoes, citrus fruits.....	do.....	10. 96	11. 80
Other vegetables and fruits.....	do.....	11. 11	13. 43
Meat, poultry, fish.....	do.....	9. 21	10. 29
Eggs.....	Dozen.....	1. 41	1. 94
Grain products.....	Pounds.....	9. 00	9. 34
Fats, oils (including butter).....	do.....	3. 72	3. 80
Sugars, sweets.....	do.....	3. 26	4. 86

¹Dairy products (excluding butter) in terms of milk equivalent.

These figures show a marked increase in consumption of milk, eggs, and sugar and a substantial but lesser increase in consumption of meat, poultry, and fish between 1942 and 1948. Potato consumption decreased but larger amounts of other vegetables and fruits were used. The rise in consumption of sugar and sweets is explained, in part at least, by the lifting of wartime sugar rationing in effect when the 1942 figures were obtained.

Of special interest to nutritionists and to market analysts is the extent to which various population groups shared in these shifts in consumption. In 1948, the third of city families with lowest incomes bought 36 percent more meat, poultry, and fish than did the third with lowest incomes in 1942. They bought 31 percent more milk in its several forms, and 68 percent more sugar and sweets than in 1942.

For the third of the families with highest incomes there was practically no change in the quantity of meat, poultry, and fish consumed in the spring of 1948 as compared with 1942. Of milk and sugars, the increases were 20 percent and 28 percent, respectively.

Data from the 1948 survey show that the effect of income upon quantities bought varied with the type of food purchased. Families with incomes of \$7,500 or more used about two-thirds more milk and meat than those with incomes under \$2,000—an average of 20 quarts of fluid milk (or its equivalent in other forms) per week compared

with 12, and an average of 14 pounds of meat, poultry, and fish per week compared with 8½ pounds. The larger size of the higher income households would account in part for the bigger purchases. Households with incomes over \$7,500 were made up of 3.8 persons; those under \$2,000 averaged 3.1 persons. Even so, families in the highest income bracket used over twice as much fresh fruit as those with incomes under \$2,000—18 pounds per week compared with 8½.

Purchase of frozen fruits and vegetables was influenced more by income than any other group of foods. Families with incomes of \$7,500 or more used almost 10 times as many frozen fruits and vegetables as did those with incomes under \$2,000.

Four cities, winter 1948

A comparison of food purchases in four cities in different parts of the country—Birmingham, Buffalo, Minneapolis-St. Paul, and San Francisco—reveals many similarities and many contrasts.

Average family expense for food during the winter of 1948 ranged from \$22 a week in Birmingham to \$29 in San Francisco. Per capita averages varied somewhat more—because of differences in family size—from \$7 in Birmingham to \$10 per person a week in San Francisco.

The greatest intercity differences in kind and quantity of commodities bought were found between Birmingham on the one hand, and the three cities surveyed in the North and West on the other. The Birmingham families bought comparatively large quantities of lard and other shortening, margarine, white flour and corn meal, sirups and molasses. Other foods that rated higher in the housewife's market order in Birmingham than in the other three cities were buttermilk, evaporated milk, fresh and cured pork, sweetpotatoes, dry beans and peas, cabbage and other cooking greens.

Diets in the three cities of the North and West contained larger quantities of fresh milk, meat (especially beef), and potatoes than diets in Birmingham. More store-bought bread and other bakery products, fresh fruit, and canned and frozen fruits and vegetables also characterized the food pattern of cities in the North and West.

Of the four cities, San Francisco households averaged highest use of cheese, beef, veal, lamb, poultry, fish, fresh and frozen fruits and vegetables. Buffalo households used the most potatoes and bakery products; Minneapolis-St. Paul households exceeded the other cities in their purchases of butter, fluid whole milk, and cream.

Although income influenced the quantity of many foods purchased, and especially was this true in Birmingham, many of the city-to-city differences mentioned above were also apparent upon comparing consumption of families at similar income levels. At both high- and low-income levels, Birmingham families used more grain products, fats, sirups, sweetpotatoes, and pork than families of similar income in the other three cities.

At high-income levels, the differences among cities are less marked, however, for those items for which average purchases are affected by income. Lard purchases in Birmingham, for example, decreased with income, and the quantities used by the higher income families there were only twice those of the families in a similar income class in Buffalo, although the city-wide average was over three times as much.

On the other hand, fresh milk purchases by families in Birmingham rose sharply with income. Whereas the average quantities purchased by all families were only 40 percent as large as in Minneapolis-St. Paul, families at a relatively high-income level in the southern city used 60 percent as much whole milk as Twin-City families of the same incomes. In Birmingham, a considerable part of the fluid milk used was buttermilk—at the lower income levels, buttermilk made up about a third of the total; but at the highest, the proportion had dropped to about a tenth.

Rural Family Diets

Studies among two groups of families in 1945 showed that even in a year when national income and total food consumption were fairly high, not all rural families were well fed.

Participating in this dietary survey were families living in the open country, 282 in a Georgia county and 237 in an Ohio county. The families kept records or made reports of their food consumption for a continuous 7-day period during the early summer. In Georgia, the foods used by about three-tenths of the families were found to provide calories and eight nutrients in the quantities recommended by the National Research Council. Nearly two-tenths of the diets provided only one-third or less of allowances for at least one of these essentials. In Ohio, more families had better diets. Four-tenths met allowances in full; another four-tenths met at least two-thirds of the allowances.

The most limited nutrients in the food supplies of families in both counties were calcium, vitamin A value, and ascorbic acid. The Ohio families had more cows providing milk for family use and more purchased food to supplement home-produced food than did those in Georgia. Families in the Georgia county would have benefited from more milk and vitamin C-rich fruits and vegetables. Two food habits that helped safeguard the Georgia diets in calcium and vitamin A value were the use of high-calcium self-rising flour and the dark green leafy vegetables. Also it may be noted that those families in Georgia who once had been clients of the Farmers Home Administration were found to have better diets than others in the same income class. This is evidence of a lasting and beneficial effect of a well-adapted educational program.

Classified by per capita rather than total income, the rural families surveyed achieved better diets with progressively higher incomes, but at no income level did the diets of all families meet recommended allowances in full. In the highest income groups shortages were in calcium, vitamin A value, and ascorbic acid—the same nutrients found shortest in diets of the lowest income groups.

Potential Demand for Food

Analyses of trends in food consumption and factors affecting choices indicate that many influences alter levels and standards of diet. In addition to the commonly recognized effects of income and formal education may be seen the imprint of new experiences. It appears that meal standards of the less well-to-do were lastingly affected by wartime situations which tended to equalize consumption—raising that of some population groups, curtailing that of others.

Between 1942 and 1948, national figures show a substantial increase in the consumption of milk; meat, poultry, and fish; citrus fruit and tomatoes. Family dietary studies indicate that home food consumption in cities increased even more than average for the country as a whole, and, as indicated earlier, some of the shifts in urban family consumption were more marked in the lower income groups than in the upper. Thus, urban families as a whole reported the consumption of 12 percent more meat, poultry, and fish in the spring of 1948 as compared with 1942, whereas the third of this group with smallest incomes increased their consumption by 36 percent and the third with highest incomes consumed about the same amount in both periods.

The figures just cited indicate that food habits can and do change, even over a short period of time, as supplies, economic conditions, and other factors change. But even in 1948, a period of high food consumption, differences among economic groups show that the limit of the capacity to consume has not been reached for many items. Thus, in 1948 if the average consumption of families with incomes below \$3,000 could have equaled the average for those in the \$4,000 to \$5,000 bracket, total aggregate consumption by urban families of milk, meat, and vitamin C-rich fruit would have been 8 to 10 percent higher.

For nutritional betterment more of some foods might well be eaten. In the winter of 1948, for example, 90 percent or more of the Birmingham families had food meeting National Research Council's allowances for the nutrients considered, other than calcium and vitamin C. Only 63 percent of the families met the allowance for calcium; 75 percent for vitamin C (taking account of average losses in cooking). In practice, these shortages can be remedied by more milk, fruit (especially citrus), and tomatoes. Thus both family preferences and nutritional needs point to larger potential markets for foods.

COMPOSITION AND NUTRITIVE VALUE OF FOOD

Facts about composition and nutritive value of food are basic to understanding the potential place of various commodities in the diet, as well as to interpreting food consumption in terms of nutritional requirements.

The Bureau has long been recognized for its compilations of information on composition and nutritive value of foods. Administrators of governmental programs, both national and international, as well as scientists, dietitians, and physicians use the Bureau's published food composition tables to answer specific questions. The general public's growing awareness of the importance of nutrition to health prompts increasing numbers of individuals to write for information on the nutritive value of diets or of specific foods that they purchase or market.

In addition to keeping up with the continuous flow of scientific literature, and compiling current knowledge in convenient form for public use, the Bureau adds to that knowledge, both through investigations in its own laboratories and through cooperative investigations with other research institutions. Under study during the last year were problems of the digestibility and energy value of foods, the availability of carotenes in foods of plant tissue, and methods for determining amino acids in food materials. Work was conducted to

compare methods for determining vitamin C, and to develop improved methods for the quantitative determination of folic and pantothenic acids, and to apply these methods to common articles of food.

Amino Acids

Adequate quantities of the right kinds of proteins have long been recognized as necessary to good nutrition. However, there are large gaps in knowledge concerning the chemical and nutritive properties of these complicated compounds. Since the role of proteins in the diet depends on the proportions that they provide of certain amino acids—the building blocks of which proteins are made—research is concentrated on learning what amino acids go to make up the various proteins, how much of each amino acid is essential in human diets, and what quantities of each are present in different kinds of foods.

The Bureau has developed microbiological methods for the quantitative determination of 9 nutritionally important amino acids and has applied each of these methods to 15 proteins and 16 foods. Although these methods have already been published separately in a scientific journal, a bulletin was prepared this year condensing for easy reference the results of Bureau research in developing both chemical and microbiological methods for the quantitative determination of the 10 so-called nutritionally essential amino acids.

An illustration of the way knowledge about proteins is being built up is the case of lanthionine. This sulfur-containing amino acid was discovered by Department chemists among the hydrolysis products of wool. Later, lanthionine was isolated in two forms, *meso* and *racemic*, from other proteins including lactalbumin, one of the proteins of milk. Bureau feeding experiments with rats have now shown that mesolanthionine cannot be utilized for growth but that racemic lanthionine, like cystine, can replace a part of the methionine as a source of sulfur. Sulfur-containing amino acids are nutritional essentials that food must provide.

Folic Acid

Among the more recently identified vitamins of the B-group is folic acid (folicin). This substance, essential to life, has been found in many kinds of green leaves and in a number of animal tissues.

During the past year, with funds made available under the Research and Marketing Act of 1946, the Bureau collaborated in the Association of Official Agricultural Chemists' referee study designed to improve and standardize a microbiological procedure for the quantitative determination of folic acid in food. Studies on the choice of enzymes used for hydrolyzing samples to free the folic acid from plant tissue have shown that takadiastase is unsatisfactory. A preparation made from chicken pancreas was found more effective in freeing folic acid than one made from hog kidney, used in some laboratories.

Relationships between growth responses of the micro-organisms and concentrations of folic acid have been reduced to mathematical linear equations. This has facilitated the calculation of errors and has given increased confidence in results through elimination of the possible distortion of growth-response curves.

Using the two test organisms, *Lactobacillus casei* and *Streptococcus faecalis*, and the standard procedures mentioned above, the Bureau has added to knowledge of the quantitative distribution of folicin by obtaining data on its concentration in 100 different foods. On the fresh edible portion basis, the folic acid content of the vegetables tested ranged from 0.04 to 0.8 micrograms per gram; the fruits, from 0.02 to 0.08. Standard samples analyzed as part of the Association of Official Agricultural Chemists' collaborative study showed such values as: Soy flour, 3.5 micrograms per gram; dried mustard greens, 8.0; dried egg yolk, 0.6; and dried brewer's yeast, 20.9 micrograms of folic acid per gram.

Pantothenic Acid

Progress also was made on establishing a standard microbiological procedure, using *Lactobacillus arabinosus*, for the study of the pantothenic acid content of foods. This vitamin is another of the more recently discovered nutrients.

Ascorbic Acid

In recent years the specificity of chemical methods for determining vitamin C (ascorbic acid) in cooked or stored foods has been questioned by the Bureau and by other laboratories. Values higher than those for the original fresh foods were sometimes observed, indicating the formation during food processing or storage of substances that behave chemically like ascorbic acid but that do not function like vitamin C in the body.

A study financed by an allotment by the Secretary of Agriculture from special research funds was undertaken to determine which of two chemical methods—the indophenol or the phenylhydrazine—used widely in this country would give vitamin C values nearest to those determined by biological assay. The foods chosen for study were stored canned tomato juice, orange-grapefruit juice, and spinach.

From the findings, it appears that both chemical methods give valid results for foods not exposed to heat treatment and not containing interfering substances. The indophenol method is more useful than the phenylhydrazine procedure when interfering vitamin C-like substances are present in a food, because a correction can be made for certain of the interfering substances. But the accuracy of the results obtained by the chemical methods varies with the nature of the food and should be evaluated in terms of bioassays.

BREAKFAST MEALS

Evidence is accumulating that the nutritional effectiveness of foods depends to some extent upon the way in which they are distributed in the day's meals. In 1946 the Bureau, assisted in part by special research funds, undertook to determine what effect, if any, the composition of the breakfast meal had upon human carbohydrate metabolism, and its relation to the individual's feeling of general well-being. At that time few data were in the literature on the biochemical responses of normal active individuals to typical American breakfasts. Recommendations for improving diets by means of the breakfast meal were based chiefly on theoretical grounds.

The Bureau's research, conducted over a 2-year period with adult women as subjects, was concerned chiefly with the effect of each of a series of controlled breakfast meals upon the rate at which glucose enters and is removed from the blood stream.

Included in the investigation were breakfasts of seven different food combinations which provided varying quantities of protein and food energy and one breakfast consisting of unsweetened black coffee only. One breakfast composed of unsweetened black coffee and doughnuts furnished about 7 grams of protein and 400 calories. Another made up of citrus juice, bacon, toast with butter and preserves, and coffee with cream and sugar, provided 9 grams of protein and 360 calories. Four breakfasts consisted of the last-named combination (with or without preserves) with the addition of (1) a cooked breakfast cereal with milk, (2) a ready-to-eat breakfast cereal with milk, (3) milk, (4) eggs. The cereal-containing breakfasts afforded about 17 grams of protein and somewhat more than 500 calories. The other two breakfasts (3 and 4) provided 22 grams of protein and about 500 calories. Another breakfast, the last-named above (4) with additional buttered toast and preserves furnished 25 grams of protein and more than 750 calories.

During the 3 hours immediately following the morning meal, the subjects having only unsweetened black coffee experienced a progressive fall in blood sugar below the fasting level. While at no time did the values fall to true hypoglycemic levels, traces of acetone were detected in the urine of three out of seven subjects and unfavorable subjective symptoms, including hunger, weakness, headache, and lassitude were often reported.

Blood-sugar curves following ingestion of breakfasts that provided 7 to 17 grams of protein and 360 to 520 calories were characterized by a rapid rise from the fasting level during the first half hour followed by a fall to the original level during the next 2½ hours. After breakfasts providing 22 grams of protein derived chiefly from milk or eggs, and about 500 calories, the rise in blood sugar was normal, but with somewhat lower average maximal figures and a delayed return to the fasting level as compared with the effect of breakfasts of approximately the same caloric value but lower protein content. A sense of well-being was consistently reported following the breakfasts that provided the larger quantities of protein-rich foods.

It was further found that the breakfast meal may influence blood-sugar levels during the afternoon following lunch consisting of a lettuce and tomato sandwich and coffee. A lower maximal rise in blood sugar was observed together with a relatively more sustained sugar level during the course of the afternoon when subjects had eaten a breakfast providing 25 grams of protein in contrast with breakfasts providing less than 10. When the lunch followed a breakfast of unsweetened black coffee only, subjective symptoms of hypoglycemia were reported late in the afternoon. These symptoms accompanied blood sugars which were below the fasting levels.

Seasonal differences in blood-sugar levels

Significant seasonal differences heretofore unreported were found in fasting blood-sugar levels. Although within the range generally

considered normal, figures for the individuals studied tended to be higher in the winter than during the summer months.

HOUSEHOLD UTILIZATION OF FOODS

To make full and effective use of many foods that are in unusual abundance, the homemaker needs information on how to prepare and cook them so they are acceptable to her family. Research has therefore been supported by Research and Marketing Act funds to develop principles and methods of food preparation with a view to increasing acceptability and improving palatability of foods in abundant supply.

Under way also are fundamental studies relating cooking methods and table quality to chemical composition, histological structure, or other physical properties of plant products differing in variety, place of production, storage conditions, or handling. In the case of live-stock products, food-preparation methods are being related to production and handling methods that affect quality.

Potatoes, apples, mature dry beans and peas, beef, poultry, and eggs are the commodities being given attention at present.

HOME FOOD PRESERVATION

Home Canning and Freezing

Comparison of frozen and canned snap beans

A comparative study of the palatability and nutritive value of home-canned and home-frozen snap beans showed the home-frozen beans superior on both counts. Quality was compared at intervals during 10 months' storage in terms of palatability, color, thiamine and ascorbic acid retention, as removed from storage and as prepared for serving.

Palatability ratings for the frozen snap beans were much higher than for parallel canned samples. Only a slight decrease in palatability occurred during storage of the frozen or canned beans.

Frozen beans retained more ascorbic acid and thiamine than the canned beans. After 10 months' storage at 0° F., ascorbic acid retention in frozen snap beans averaged 58 percent, compared with 30 percent for the canned beans stored at 75°. Cooking for serving resulted in further losses of approximately one-half of the remaining ascorbic acid in both frozen and canned beans.

Frozen beans, when cooked for serving after 10 months' storage, retained an average of 76 percent of their original thiamine content and canned beans 70 percent. Samples studied were from four successive plantings of Topcrop snap beans, a full-podded stringless variety recently developed by Department scientists.

Conference on home food freezing

In March 1949 the Bureau sponsored a conference attended by food-freezing specialists from institutions in various sections of the country. The group reviewed recommendations and procedures for the preparation, packaging, and freezing of fruits, vegetables, and prepared and precooked foods in home freezers and freezer lockers.

For this conference Bureau staff reviewed and summarized more than 300 papers and bulletins as well as many unpublished data. The

information was developed into outlines of tentatively recommended and alternative procedures for home freezing which served as the basis for discussion. The group agreed on many recommendations as satisfactory for inclusion in Department and State publications on the preparation, packing, and freezing of fruits and vegetables, and recommended further intensive research on preparation, packaging, and freezing of prepared and precooked foods.

Home Dehydration of Vegetables and Fruits

A comprehensive report prepared this year puts into permanent form for reference by research workers results of the Bureau's wartime investigations to find ways of improving flavor, texture, color, and nutritive value of home-dehydrated food. The findings had earlier provided a basis for popular wartime publications and extension programs dealing with food conservation.

In this work factors affecting quality, ascorbic acid content, and cost of processing certain home-dehydrated vegetables and fruits were investigated, including methods of pretreatment, dehydration temperatures, storage, reconstitution, and preparation of the dehydrated food for the table. Directions for cooking and serving dehydrated vegetables were developed.

PHYSICAL PROPERTIES OF FABRICS AS RELATED TO CONSUMER USE

Shrinkage and Stretch of Woven Fabrics

Fabrics of different fibers and construction react differently to various cleaning procedures. Some materials shrink, others stretch; some change only slightly, others excessively.

To obtain more data on the dimensional changes that occur in woven fabrics, the Bureau investigated the performance in laundering, dry cleaning, and wet cleaning of 30 cotton, rayon, and wool materials commonly used in clothing. Findings were published in Circular No. 793, *Dimensional Changes in Certain Cotton, Wool, and Rayon Woven Fabrics During Various Cleaning and Pressing Processes*.

Though there was considerable variation in the dimensional changes resulting from laundering, dry cleaning, and wet cleaning within various fiber groups, each type of fabric followed a somewhat definite pattern. For all fabrics shrinkage was the change most frequently reported. In all cleaning methods the amount of shrinkage was greatest for wool and least for the continuous filament acetate. Stretching occurred chiefly in the rayon fabrics.

Laundering tended to cause the most shrinkage; dry cleaning the least. The wools showed progressive shrinkage with each cleaning, especially with laundering. Cottons had a tendency to shrink progressively in the first three treatments by all cleaning procedures.

Shrinkage in all fabrics was found to be considerably reduced by applying tension to the wet or damp materials during pressing—rayons were easily brought back to their original dimensions.

The amount of shrinkage resulting when fabrics were wet-cleaned was not as large as when the fabrics were laundered. This is at

variance with results of previous studies in which a different method of wet cleaning was used.

Properties of Plated Knit Fabrics

Plating, the knit-fabric construction in which two yarns are used—one on the face, the other on the back of the fabric—offers an opportunity of adding useful properties to such fabrics through selection of kind and amount of fibers, and by variations in fabric construction.

Plated fabrics made in the Bureau's laboratory of two yarns of different fibers were found to have physical properties quite different from those made of two yarns of the same fiber. For example, plated fabrics knit of cotton, wool, or rayon combined with nylon, had considerable strength and abrasion resistance, whereas fabrics made of all cotton, all wool, or all rayon were much weaker and less resistant to abrasion than all-nylon fabrics.

Neither the elastic (instantaneous) recovery nor the creep (delayed) recovery of the knit fabrics could be predicted from that of the yarns from which they were made. Both wool and nylon yarns had high elastic recovery (83 percent at 4.5 percent strain), but the fabrics knit from them differed greatly.

Plated fabrics made of two kinds of yarn often had high elastic recovery even though one of the yarns when used alone produced fabrics of low recovery. For instance, cotton, viscose rayon, or nylon combined with wool produced fabrics of high elastic recovery, ranging from 80 to 90 percent for small strain in the crosswise direction. These values were considerably higher than for plated fabrics of all cotton, all rayon, or all nylon.

The elastic recovery of knit materials also differed with the type of construction and with the number of courses per inch. Plated fabrics were higher in this property than similar plain knit fabrics; also the materials knit with 40 courses per inch had greater recovery than those with 32 courses.

Dimensional change in laundering varied with the type of construction, the number of courses per inch, and the fiber content. The plated fabrics usually changed less in length or width than the plain knit fabrics studied; those knit with 40 courses per inch shrank or stretched less than those knit with 32 courses per inch. The materials containing wool changed the most in dimensions, and those containing nylon changed the least.

FAMILY SELECTION OF GOODS AND SERVICES

Household Soaps and Detergents

The wide variety of soaps and other detergents now on the retail market is confusing to homemakers who have had little information concerning the relative merits of these products for laundering and for other specific household uses.

The Bureau has determined the soil-removing effectiveness of 15 soaps, 1 soap powder, and 35 synthetic detergents for the home laundering of cotton, and the results have been made available to homemakers, research workers, and manufacturers of detergents through technical and popular publications. The soil-removing efficiency of

the detergents was measured by the change in light reflectance which each produced during the laundering of artificially soiled cotton fabric under standardized conditions. Temperature, hardness of water, and different concentrations of detergents were all considered.

The unbuilt soaps (those without alkaline salts) were equally efficient in removing soil under the conditions of the study. All removed more soil in hot water than in lukewarm. All were much more effective in soft water than in hard, since it takes considerable soap to soften hard water. Among the built soaps there was little difference. In general they were only slightly more effective than the unbuilt. All removed considerably more soil in hot water than in lukewarm.

In soft water the unbuilt synthetic detergents were from two-thirds to three-fourths as effective as the soaps, but in hard water they were somewhat more effective than soaps, especially when used in small amounts. Like the soaps, they were generally more effective in hot water than in lukewarm.

Some of the phosphate-built synthetic detergents removed as much soil as the soaps in soft water and were more efficient than soaps in hard water. Other built synthetics studied were less efficient—both in soft and hard water.

Clothing Selection and Care

Men's suits

High prices have intensified consumers' interest in learning how to judge merchandise quality when making purchases. The Bureau's latest publication in a series of clothing-buying guides, Miscellaneous Publication No. 688, *Buying Men's Suits*, discusses the materials and workmanship used in men's suits of different qualities. Special attention is drawn to hidden values such as kinds of interlinings, paddings, the amount and quality of hand sewing, and the amount of pressing done during construction—points often overlooked by consumers but which greatly influence the fit and serviceability of a suit.

Dresses for housework

Bureau studies have provided the ground work for developing standards and specifications for the construction of housework dresses. A tentative draft of such specifications was prepared for consideration of the Consumer Interests Committee of the American Home Economics Association. This proposal, based largely upon Bureau research, includes such construction details as size of stitch; thread for construction processes; methods of marking seams and locations for pockets and darts; method of attaching collars; treatment of fabric in edge finishes; width of edge finishes; kinds of buttonholes; and methods of locating and attaching buttons, belts, and belt loops.

Wherever applicable, findings of these studies have been included in the revision of Federal Specifications such as for seersucker and corduroy bathrobes, hospital bed shirts, and attendants' coats.

Selection of Home Freezers

Research in the Bureau laboratories regarding methods of determining freezing capacity and operating characteristics has helped form the basis for decisions by the Home Freezer Standards Committee of

the American Society of Refrigerating Engineers. These procedures are being recommended for inclusion in an American Standard to be formulated by the American Standards Association. In addition, investigations of the operating characteristics and performance-in-use of home freezers have provided the facts for a publication on the selection and use of home freezers, written for home demonstration agents, teachers, and others who advise in regard to family purchases.

One decision facing the prospective buyer of a home freezer is the choice between the upright and the chest type. In a comparison of 11 chest-type freezers ranging from 5.5 to 18 cubic feet and 4 upright-type freezers ranging from 5.5 to 28 cubic feet, the Bureau found very little difference in cost of operation between the two types. The chest-type freezers averaged 0.341 kilowatt-hour per cubic foot per 24 hours compared with 0.332 for the upright type. With freezers of approximately the same size, greater differences were found among freezers of the same type than between the averages for freezers of the different types.

Essential to quality in frozen food is the freezing of the product within a 24-hour period after it goes into the freezer and the maintenance of proper storage temperature. To safeguard these conditions, Bureau studies have shown that a separate freezing compartment or special facilities for freezing should be available if a user expects to freeze as much as 10 percent of the total capacity of a freezer at any one time.

The design of the freezer should be such that the compressor will run continuously from the time a freezing load is put into the freezer until it has been reduced to storage temperature. Or the freezer should have an adjustable temperature control and the manufacturer should supply instructions for its manipulation to bring about the continuous operation.

Freezer alarms

Alarms are an important accessory to freezers in order to warn users when the current has been interrupted or when the freezer temperature rises above that needed for safe keeping of foods stored. From a Bureau study of freezer alarms, the following specifications for an ideal freezer alarm have been formulated:

The alarm should have a positive audible signal; it should be consistent in the temperature at which the signal is activated; it should turn off automatically and be ready for action again when normal conditions are resumed; it should be powered by means other than the freezer circuit; it should signal if the freezer circuit breaks and if the temperature in the freezer rises above normal cycling values; it should be provided with manual means for turning off the signal; and it should be provided with easy and accessible means for checking the alarm's action at any time. If the alarm is to be installed in an already built freezer, it should be equipped with leads that interfere as little as possible with the gasket seal and that are flexible enough to permit the desired location for the sensitive bulb of the alarm.

Performance Requirements of Electric Range Ovens

Standardized test procedures to be used in evaluating the performance of electric range ovens have been developed by the Bureau in cooperation with a committee of the American Standards Association.

The procedures standardized include the recipes and techniques for mixing the ingredients of the test products to be baked—layer cake, sponge cake, biscuits, and bread. Also standardized were the specifications as to utensils to be used, placement of products in the oven, time and temperature for baking, and the established limits of acceptability of the baked products in terms of appearance characteristics such as color and symmetry. The color limits for acceptability of each of the various products were established by means of light reflectance as measured by a photoelectric unit. Plans are under way for production commercially of cards of standardized color to guide in judging the acceptability of the baked products, when testing the performance of range ovens.

HOUSING NEEDS AND PREFERENCES OF FARM FAMILIES

The planning of efficient, livable, and economical farmhouses should be based on adequate knowledge of family living requirements and on standards established through research, for the minimum as well as the desirable space that will meet these requirements.

This calls for facts as to the kind and scope of household activities characteristic of families in different parts of the country and the preferred location for these activities, as affected by climate and other factors. That securing such data should be the first step in a program of housing research was the decision of a group of home economists and agricultural engineers from land-grant colleges discussing the problem in 1944.

In 1947 Research and Marketing Act funds made possible the initiation of a large-scale cooperative study of factors affecting housing needs of farm families on a regional and national basis. Committees of technically trained representatives of State Agricultural Experiment Stations and the Department planned and supervised the field work in each region.

Through this survey information is being obtained on the type and scope of major activities carried on in the home and the frequency with which they are performed; the family's preference for the location of each activity; and the quantities of supplies or other family possessions requiring storage. Also, the data will include the equipment and furniture which the family plans to purchase within the next 2 years. This information is needed for developing space requirements for activities and storage and for recommendations for efficient space arrangements within the house.

The family's view on housing features is being obtained on such items as the preferred number of stories in the house, whether a basement and attic are wanted, preference for a bedroom on first floor of a two-story house, number and the preferred types of fuel and heating equipment. As background information for evaluating the preferences stated, facts are being obtained about the present dwelling and its equipment—number of stories; number and kind of rooms; installed utilities, as running water, heating facilities, and electricity; number, type, and size of major pieces of equipment and furniture.

General information on size, composition, type, and economic status of the family, size of household, and type and size of farm are also being obtained for use in analyzing the information on activities, in describing the sample, and in checking on its accuracy.

The report of the field study made in the northeastern region is being published by the Cornell Press. In other regions field work has been completed, and tabulation and analysis of the data are in progress. It is hoped that the reports of all four regions will be published, or ready for press by July 1950.

GUIDANCE IN FAMILY SPENDING

Family Budgets

Many families appeal to home economists for assistance in planning the management of their finances. Some want help in stretching a meager income to cover bare necessities. Others with good incomes find themselves short of cash and without things they feel they might have if their dollars were spent more carefully. To assist extension workers, teachers, and others who help families make spending plans, the Bureau this year issued a publication, Miscellaneous Publication No. 661, Guiding Family Spending, which describes the steps that families follow in planning the best use of their funds. Expenditure patterns suggested as guides were derived chiefly from Bureau studies of family expenditures as affected by income, size of family, differences in family financial reserves, as well as in family needs and preferences.

Family Food Plans

Closely related is another Bureau publication, Miscellaneous Publication 662, Helping Families Plan Food Budgets. This bulletin was written for nutrition leaders, teachers, and social workers—especially those who assist families in working out food plans to suit individual needs. Explanatory and basic information on how to develop and use food guides was included, in addition to master food plans at low and moderate cost levels for 19 age, sex, and activity groups. These plans are helpful in figuring quantities of different types of food needed by families of different sizes and composition whether all food is bought or part is raised at home. In developing the plans, the Bureau took account not only of the quantities of various nutrients recommended by the National Research Council but also of dietary patterns of various income groups, composition of foods, relative food costs, and present and potential food supplies.

SUMMARY OF RESEARCH PUBLICATION

The record for the year July 1, 1948, to June 30, 1949, of Bureau publications issued for the use of homemakers, research workers, and others desiring information in the field of human nutrition and home economics is as follows: 32 publications printed or submitted for printing; 17 processed publications issued; 33 technical articles for professional journals published or submitted for printing; 15 popular articles published; 102 press releases, press picture series, press statements, and fact sheets prepared; 28 radio or television scripts prepared and broadcast; and 1 motion picture prepared embodying results of research. During the year there were distributed almost $5\frac{1}{2}$ million copies of the currently available printed publications issued through the Government Printing Office.

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